DOCUMENT RESUME

ED 231 741 SO 014 981

AUTHOR Berg, Roger
TITLE Analytical Criteria for Microcomputer-Based Simulation/Games.
PUB DATE Jun 83
NOTE 38p.; Paper presented at the Annual Conference of the Social Science Education Consortium (20th, Athens, GA, June 8-11, 1983).
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052) -- Information Analyses (070) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Computer Programs; Curriculum Development; Educational Objectives; Educational Research; Elementary Secondary Education; *Evaluation Criteria; *Games; Literature Reviews; *Microcomputers; Program Effectiveness; Research Needs; *Simulation; Social Studies; Technological Advancement
IDENTIFIERS *Computer Uses in Education

ABSTRACT

Written for practitioners, curriculum developers, and researchers, the document presents evaluation criteria which were developed from an extensive review of research along with the experiences of the author with microcomputer social studies simulation games. The major portion of the document presents the review of research according to seven concerns: definitions of microcomputer-based social studies simulation games, effectiveness of the games, effectiveness of computer-based education, methods for reviewing simulation games, methods for reviewing computer software, instructional theories related to computer-based education, and methods for reviewing social studies simulation games specifically. The second part of the document presents four categories of questions to use when evaluating software programs. The first group of questions is directed toward the new user and the second group assumes some level of computer literacy on the part of the user. Both groups are concerned with computer programs in general. The third group of questions focuses on social studies simulation games specifically: what social science concepts are being taught, how the algorithm is flowcharted, how much flexibility is possible, what skills are used by the learner, and what kinds of group skills might be promoted. The last list provides questions for researchers and curriculum developers which concern objectives, adaptability, affective outcomes, graphics, and necessary changes in school organization. (KC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

X This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Roger Berg

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

ED231741

ANALYTICAL CRITERIA FOR MICROCOMPUTER-BASED SIMULATION/GAMES

Roger Berg

Department of Teacher Education

University of Nebraska at Omaha

514 Kayser Hall

Omaha, Nebraska 68182

Paper presented at the

Twentieth Anniversary Conference

of the

Social Science Education Conference

University of Georgia

June, 1983

SO 014 981

Professionals in education can have more than one role. Their roles are characterized as practitioner, researcher and developer. Practitioners are expected to operate in a variable and real world and try to control those events which would promote skills, knowledge, and attitudes. Researchers have uncertain theory to guide them as they try to advance understanding. Developers have tasks to perform which are not constrained by the real world of students and schools nor the necessity of adding to present understanding. Developers attempt to provide instructional materials and activities for use by practitioners and, it is hoped, reflecting the accomplishments of researchers (Schen, 1977). There is a knowledge-production-to-use continuum implied by these roles. These roles and the different products of educational inquiry that they imply have been suggested as appropriate ways to define the possible missions of teacher educators by the American Association of Colleges of Teacher Education (Howsam et al., 1976).

Having all three roles to satisfy leads to diverse perspectives. In the last few years, I began to use microcomputers and was struck by the different experience they provided from the simulation/games I had used with students. As I read available reviews, I was often disappointed because I found them not very helpful to my understanding of the programs they reviewed. Their checklist approaches were usually not appropriate. I found the reviews neglected either social studies or social science or simulation/gaming or, in some cases, computer-based education criteria. Furthermore, the audiences

for whom these reviews were written seemed to be relatively unsophisticated practitioners who were looking for materials beyond drill and practice in an area, social studies, which had little of even that mode. As someone who sees himself as a sophisticated practitioner of simulation/gaming, a developer of some simulation/games, and a sometime consumer and retailer of research about simulation/games in my classes, I decided to find some ways to improve the analyis of microcomputer-based social studies simulation/games.

In this paper I will try to identify analytical criteria gleaned from reading, practice and reflection. These critieria may help practitioners make better decisions. They may help developers clarify their tasks in the development of microcomputer-based social studies simulation/games. And finally, since one discipline's assumptions are another discipline's objects of inquiry, the suggested criteria may lead to some research questions.

There are several sources from which criteria might be derived. This paper will focus upon those aspects of simulation/games which might best illuminate ways to make decisions about microcomputer-based social studies simulation/games. Nevo (1983) notes that "known standards set by experts or other relevant groups or the quality of alternative objects" can be bases for evaluative criteria. Thus, only areas which might supply criteria for analysis of microcomputer-based social studies simulation/games will be explored. These areas include research and evaluative literature about

simulation/games, instructional design and instructional psychology, as well as the literature of the social studies.

The following questions will serve to focus this inquiry into microcomputer-based social studies simulation/games:

1. What are microcomputer-based social studies simulation/games?
2. How effective are simulation/games?
3. How effective is computer-based education?
4. How are simulation/games reviewed?
5. How is microcomputer courseware reviewed?
6. What can be learned from instructional theory about microcomputer-based education and simulation/games?
7. How might microcomputer-based social studies simulation/games be reviewed?

The answers to these questions may help practitioners, developers, and researchers in their uses of microcomputer-based social studies simulation/games.

1. What are microcomputer-based social studies simulation/games? Since several disciplines are being used to inform this effort and there are intranational and international differences in the use of these terms, some definitions and understandings may be useful. Among these diverse perspectives, several different uses are made of the terms simulation, games, gaming and simulation/games (Association for Educational Communications and Technology, 1977; Gibbs, 1978; National Council of Teachers of Mathematics, 1981; Seidner, 1976; Stadsklev, 1974).

A simulation/game is an instructional strategy which uses

simulations designed or adapted for instructional purposes. These simulations often have a game-like aspect. As an instructional strategy, simulation/games usually involve an entire class in active roles and, until recently, did not usually employ a computer.

Simulation/games differ from simulations and games as separate terms. Schools use games for drill and practice and sometimes for amusement. Simulations are rarely used in the social studies since simulations are usually used to demonstrate complex problems for analytical or predictive processes as in science classes. Simulation/games differ in that they are instructional simulations which often have a game-like aspect. Simulation/games differ from roleplaying in that roleplay is usually less structured and roles are taken by only a few members of the class. Also simulation/games are often based upon social science models simplified for instruction. A further delineation is that this paper will contrast microcomputer-based social studies simulation'games with classroom simulation/games. These have also been called interpersonal ascendant simulations and machine/media ascendant simulations (Twelker, 1969).

Although each classroom simulation/game may have a different process for its conduct they can be thought to have a common format as an instructional strategy. Joyce has suggested that all instructional simulations should have the following phases: an introduction in which topics and concepts as well as an overview are given; a training session in which rules, roles and some practice are supplied; the operation of the simulation/game in which participants play the game with help from the person(s)

leading the simulation/game; and finally, a debriefing phase in which summary and analysis occur (Weil and Joyce, 1978).

Although there have been no particular characterizations of microcomputer-based social studies simulation/games in the literature, they can usually be said to involve solving a particular problem through repeated trials. On the basis of these trials, students usually can infer enough about the algorithm upon which the simulation/game is based to successfully solve the game portion of the simulation/game. The solution to the game should require successful and appropriate decisions about the simulated social science model.

2. How effective are simulation/games? There have been several reviews of simulation/games emphasizing different aspects of evaluation. Roberts (1976) supplies a comprehensive review. In 1974, the SSEC summarized data which it had gathered in a multi-state survey of non-computerized simulation/games with the recommendation that "many more teachers would find it worth their while to explore the possibilities of using simulation/games" (Chapman and Cousins, 1974). Other reviews examine the components of simulation/games (Gillespie, 1972), simulation/games as part of a curriculum design process (Gaines, 1973), or simulation/games from the viewpoint of a simulation/game designer (Stadsklev, 1969). Several reviews of research, research papers, and reviews of simulation/games have been published in Social Education (Bagley, 1973; Pierfy, 1973; Henderson and Gaines, 1971; Wentworth and Lewis, 1973). However, no paper has tried to examine the microcomputer social

studies simulation/game.

An extensive literature supplies many studies of simulation/games. What follows are some relatively safe generalizations about simulation/games. As with other such lists of generalizations, these are based upon an examination of several studies and, therefore, are qualified.

Studies of simulation/games have been difficult. Few studies have been done which compare the effects of several simulation/games with one group of people, one simulation/game with several groups of people, or several simulation/games with several groups using the same measures. However, even where such studies have been conducted there are problems of generalizability since no participant will experience and therefore respond in the same way and in whole class simulation/games it is unlikely that the same result would occur with different classes. Thus, conclusions about simulation/games are more tentative than about other instructional techniques (Pierfy, 1977).

Simulation/games increase motivation and interest. Although there is some disagreement about why simulation/games increase motivation, several studies report this result (Bredemeier and Greenblat, 1981).

Simulation/games, in general, are no more or less effective in enhancing cognitive learning than other instructional strategies. Although some studies report less cognitive learning, there are others reporting greater cognitive learning than with an alternative instructional strategy (Greenblat,

1982).

Simulation/games may produce better retention than other strategies. (Greenblat,1982) The results that support this conclusion are indicative but notable since computer-based education has not been able to substantiate such a claim.

Simulation/games are reported to influence attitudes in some instances. The results here are mixed and no conclusions can be reached (Orbach, 1979).

3. How effective is computer-based education? Another area from which criteria for the analysis of computer-based social studies simulation/games might be derived is computer-based education. For some reason, most meta-analyses have combined computer-managed instruction, tutorials, and drill and practice exercises. Among the research summaries of computer-based education are a small percentage of studies on the use of simulation/games. Nevertheless, some of the findings are those from which analytic criteria might be derived.

Computer-based education leads to higher scores on criterion tests. It remains to be seen if more conventional (albeit not more appropriate) measures such as achievement tests would yield similar responses. Analyses conclude that computer-based education yields gains of one-half of a standard deviation at the elementary level (Grayson, 1982), one-third at the secondary level (Kulik, Bangert and Williams, 1983,p. 22), and one-fourth at the college level (Hall, 1982).

Computer-based education appears to be more efficient. Claims are made that learning time is reduced forty to fifty

percent when compared with traditional instruction (Hall, 1982).

Computer-based education seems to improve student attitudes toward computers and subject matter. Although these results are widely reported (Bracey, 1982; Hess and Tenezakis, 1973; Kulik et al., 1983), it is difficult to determine the source of this socioaffective outcome. Some studies in progress (Bracey,1982) suggest that a student's feelings of efficacy as a learner or general locus of control may be improved by computer-based education.

Computer-based education may increase retention. Although some claim that this outcome is substantiated (White, 1983; Hall,1982), other analyses suggest slight positive results (Kulik et al., 1983).

Computer-based education may be feasible for small groups of students as well as individuals. This was observed at Columbia University's Electronic Learning Laboratory (White, 1983) and is congruent with other reports. One study concludes that "as many as four students could use a CAI terminal simultaneously and learn as much as students working alone"(Okey and Majer, 1976).

4. How are simulation/games reviewed? There are few large sets of criteria for the analysis of simulation/games. Horn and Cleaves (1980), the most complete single source of analytic criteria, contains formats suggested by the editors and other formats proposed by the individual essayists and reviewers. The criteria although common to all simulations reviewed in evaluative essays are applied differently and selectively by each of the authors.

However, it can be concluded, that the following skills and activities are appropriate categories from which criteria for most simulation/games might be formed:

Information Processing--analysis, planning, gathering information

Proposals and Lawmaking--opposing proposals, voting on proposals, writing proposals

Group Activities--debate, discussion, problem-solving,

Human Relations--competition, interviewing, forming coalitions, persuading

Role Playing--as an individual, a group role, a work function, switching roles

Resource Management--survival, maximizing resources, managing resources, trading resources

Evaluation (exclusive of debriefing)--self, by peers

Other criteria include simple continua dealing with model validity, flexibility, clarity of rules, depth of content and quality of accompanying materials.

Individual evaluative essays also suggest some particular criteria for analysis. A review of ecology simulation/games rates these simulation/games on the extent to which content, awareness and social skills might be learned (Schaefer et al., 1980). An economics evaluation essay classifies simulation/games by how much they promote competition, compromise and cooperation (Pascale and Ehrman, 1980). The "percentage of time allocated to affective considerations" was used to classify simulation/games about energy and environmental quality (Bottinelli, 1980).

Futures simulation/games were rated by which values were promoted (Plummer, 1980). A review of simulation/games on the topic of international relations suggests that there is an inverse relationship between flexibility and abstraction (Suransky, 1980). Finally, the theoretical schools represented (values clarification, reality therapy) became the basis for classifying self-development simulation/games (Farra, 1980).

5. How is microcomputer courseware reviewed? There are as many systems for reviewing software as there are for reviewing simulation/games. Most of these software review systems can be categorized as consumer information systems and/or general review systems to be applied by the consumer. A second level of review systems are those designed to be applied by review teams but which use a common format for all courseware. A third level would use specialized formats for different instructional models applied by review teams.

There appears to be an anomaly in the conventional wisdom about currently available courseware. On the one hand, many would agree with the assertion that "95 per cent of all the programs carried should never have been offered for sale" (Grayson, 1982). On the other hand, "children in the Computer-Assisted Tutoring System at Teachers College have worked eagerly on a software program that adult evaluators said was quite awful"(White, 1983). Similar successes were reported by early users of person/ascendant and machine/ascendant simulation/games.

Consumer information and general review systems can be found everywhere. The consumer information systems are filled with

shibboleths about not purchasing any hardware until one has decided which software meets one's needs and the importance of purchasing enough memory. Educational consumer information review systems are a little more helpful. These include information about the availability of previews, money-back guarantees, easy backup of diskettes, and field-test data (Electronic Learning, 1982b). General review systems are also widely found. They seem to be based upon rather simple, descriptive and general models of instruction. Some general review systems criteria are those which might be used to select any curricular materials. Other criteria which are based upon the particular capabilities of the microcomputer can be helpful but are likely to be applied rather haphazardly (Electronic Learning, 1982c). Review systems, both consumer and general curricular or simple instructional design, are necessary and helpful but probably should not be the only guides to a decision.

The second type of review system is more useful since teams of experienced professionals can apply more sophisticated criteria to courseware. These systems may report their findings on one or more pages but these reports are usually based upon the application of an evaluator's guide by a team of professionals. The Northwest Regional Education Laboratory system attends to the potential of the microcomputer more than other review systems. This review system is based upon a large and well-documented guide (Microsift) which was nationally field-tested (Marler, 1981, p.17). Similarly, EPIE and the Microcomputer Resource Center at Columbia University sponsored a

study to develop a similar instrument. This instrument seems to lean more heavily than others upon ideas from instructional design and instructional psychology. Some aspects of this study (Cohen, 1982) can be seen in the EPIE and Consumers Union Micro-Courseware PRO/file and Evaluation review system. A third system, the CONDUIT review system, tends to be used to describe materials for the college level. The CONDUIT system attends to the concerns of the scholar, the author as communicator, the teacher, the student and the computer specialist (Anderson, 1980). Although these three systems are the most complete review systems, they provide few explicit criteria for analyzing microcomputer-based social studies simulation/games.

6. What can be learned from instructional theory about microcomputer-based education and simulation/games? Instructional design and instructional psychology both can make contributions to understanding the microcomputer-based social studies simulation/game. Martorella (1982) delineated the contribution they can make to text design. As Bunderson and Faust (1976, p.59) have noted "whenever emphasis is placed on hardware technology or its design and development the artistic approach is easily adopted. This has been true of the field of CAI. Institutions or organizations that have focused on the development of interactive graphics, simulations, and gaming have tended to ignore principles of systematic instructional development and to focus on the affective and aesthetic qualities of their product." The following discussion of possible contributions is meant to be indicative and cannot claim to be

more than a sample of possible analytical criteria.

Although it has roots in educational psychology, instructional psychology is a relatively new and changing field. Over the past fifteen years it has moved from postulating hierarchical structures of learning to using artificial intelligence models to understand learning (Menges and Girard, 1983). Instructional design has been on the scene for many years in various guises, but the Journal of Instructional Design was only begun in 1977. Together these disciplines can be characterized as the sources for instructional theory. In turn, instructional theory has been the single most important source for conceptual developments in courseware for microcomputers. From this literature, some further criteria for practitioners, developers and researchers may be gained.

Roblyer (1981) has observed that although "selecting optimal sequences of learning events has by no means reached the state of scientific procedure, knowledge of learning theory does play an important part. This knowledge is lacking in most programmer-designers working in the field today, although the knowledge is readily available." When Roblyer is noting the lack of learning theory, he is particularly concerned with its application in instructional design. Although recent theories proposed by instructional psychologists have not yet had the effect of those instructional psychologists writing in that field for several years (Braden and Sachs, 1983), instructional designers as demonstrated by Wildman and Burton (1981) have sought to integrate instructional psychology into their decisions for the design of instructional systems. Consequently, much of

instructional design attends more rigorously to instructional psychology than social studies text materials as noted by Martorella (1982).

Gagné is the most used instructional theorist within the field of instuctional design (Braden and Sachs, 1983). Wager (1982) uses Gagné's events of instruction to suggest an algorithm for simulations. He applies this and other algorithms to the design of computer software. As Gagné and Briggs (1979, p. 157) and Wager (1978) note, not all nine events are necessary in any lesson and therefore Wager uses those he judges most relevant to simulations. Wager says that "this type of program is often used to teach the relationships between variables by the 'discovery' method" (Wager, 1982, p.266). Typically, according to Wager, a stimulus is presented, a response is elicited, and feedback is presented to the learner according to an unknown algorithm. The algorithm modifies the stimulus as well as provides other feedback which the learner must ultimately use to solve the simulation.

Graphics are lauded as having great potential for computer-based instruction. Merrill (1981) applies Gagné's domains of learning as organizing theory to provide guidelines for the use of graphics in instruction. Dwyer (1978) treats the same topic in a textbook which cites over 650 studies from a variety of nearly as many research[illegible]s. These sources are representative of those applications of instructional theory available to enrich the ubiquitous software criterion which typically asks whether or not graphics are used well.

Learning theorists with various perspectives can illuminate issues in the design and use of microcomputer-based social studies simulation/games. Davis (1980) postulates frames (an idea similar to Piaget's schema) which are structures representing information. These structures can be built up and retrieved from memory as needed. He states that their existence can best be demonstrated in mathematics as students make mistakes and reveal idiosyncratic structures. Allen (1975) eclectically combines theories and aptitude-treatment interaction studies to develop prescriptions in instructional design for students with higher or lower mental abilities. Gropper (1976) suggests that too many instructional designers are communication specialists who emphasize stimuli rather than learner responses. As part of a response-oriented media selection model, he makes some sensible prescriptions for the materials and processes which should accompany the media he classifies as active carriers, simulations and computer-assisted instruction. Jay (1983) presents some specific and sensible prescriptions for courseware design and evaluation based upon human information processing abilities. Tennyson (1981), while noting that cognitive psychology has presented a minimum of information-processing theory for instructional designers, asserts that principles rather than intuition should guide the design of computer-assisted instruction programs. For example, several review systems ask whether learner control of a program is part of a software package. Tennyson points out that studies have demonstrated that learners frequently terminate the program before they have attained the program's stated objective.

Tennyson shows how a learner self-assessment component can remedy this situation.

Gagné classifies simulations as intellectual skills since he sees them as the higher order rule-learning component of that domain. Critics of his theory (Strike and Posner, 1977) have suggested that the learning hierarchy approach may not reflect the conceptual structure of content or individual objectives. It may be suggested that simulation/games, either person/ascendant or machine/ascendant, might be classified as part of Gagné's cognitive strategy domain of learning (Gagné, 1972b, p.4). Although he seems to reserve this domain for the producton of novel solutions, the processes described seem to correspond to what might occur during the reflective debriefing of a simulation/game. Since Gagné's domains of learning and events of instruction remain important instructional design principles, this classification may be important for both developers and researchers.

Alternative theories about problem-solving behaviors have tended to use cybernetic or artificial intelligence theories to suggest models. Newell (1982) compares paleontology to computer science by noting that paleontology's "major conceptual advances occurred by stumbling across the bones of immense beasties" rather than through theoretical prediction. He believes that some advances in artificial intelligence may also result from practice rather than theory. The foregoing is not intended to suggest that artificial intelligence does not supply useful notions. A tutorial (Stefik et al., 1982) on techniques of

expert problem solving systems collates several notions useful for developers and reserchers. Greeno (1978) applies concepts and methods of cognitive psychology and artificial intelligence to the analysis of problem solving. Thus, artificial intelligence finds many models for problem solving or inquiry. Traditionally, at least for pedagogical purposes, the social studies has posited a method of inquiry or problem solving. Strike and Posner (1977) discuss the epistemological position that the above approaches demonstrate and contrast it with the traditional position that the social studies has espoused.

7. How might microcomputer-based social studies simulation/games be analyzed and reviewed? Combs(1978) predicted that microcomputers would lead to greater use of simulation/games. A Delphi study of trends in the production of instructional materials confidently predicts that simulation/games will increase in popularity with the proliferation of microcomputers (Dayton, 1981). Both predictions imply that all three professional role groups will need better analytical criteria.

There are three issues yet to be discussed. First, the idea that special criteria can be used is explored. Second, the use of social science models is identified. Third, some examples that justify the use of microcomputer-based social studies simulation/games are discussed. In conclusion, some questions which might provide a framework for the development of criteria are offered.

Several writers have suggested ways to improve the review of courseware. Cohen (1983) has suggested that a distinction be made between general instructional attributes and those specific to the design of microcomputer courseware. She supplies some generalizations to be considered in the design of courseware. Roblyer (1981) compares the PLATO and Standford/CCC models for courseware design. Besides noting some essential criteria, he suggests that differential criteria are also useful. It is suggested that besides the local program criteria that practitioners often use, special criteria be developed to reflect the particular design requirements of simulation/games.

The literature of simulation/gaming demonstrates that social science models can be used for instruction (Greenblat and Uretsky, 1977; Greenblat and Duke, 1975; Inbar and Stoll, 1972). Outside of social studies, social science, and simulation/gaming literature, there is little acknowledgement of these models. Lave and March (1975) provide four basic social science models: choice, exchange, adaptation, and diffusion. These might serve as bases for practitioner decisions and developer planning.

My experience has been that many in education consider simulation/games as games and therefore frivolous and unnecessary activities. Denenberg (1982) suggests similar attitudes exist in higher education. However, there are several justifications that developers and practitioners might use for microcomputer-based social studies simulation/games. Simulation/games can be among the most easily managed forms of action learning (Mehaffy et al., 1981). Klassen and Rawitsch (1981) point out that microcomputer-based social studies simulation/games can provide the laboratory

experiences that the social studies has usually lacked. Cohen and Bradley (1977) used a simulation/game as the third cognitive task, problem solving, in Taba's instructional strategy. The incorporation of such perspectives into software and the reviews analyzing software may help establish the educational relevance of the activities themselves rather than the content and concepts included.

The following lists of questions can be used to develop criteria for the analysis of a microcomputer-based social studies simulation/game.

The practicioner would want to know:

1. Where does it fit in the curriculum?
2. Are there enough support materials so that other students are occupied profitably?
3. Can all students use this software with understanding?
4. How much content does it carry?
5. Which classroom organizational changes must be made in the use of this program?
6. How well do students learn when this software is used?
7. What extra work for the teacher is involved in the use of this software?
8. Besides information from student use, what information is available from teacher use of this software?

The above concerns are generic to new users of microcomputers in the classrooms.

In addition to answering new user concerns, reviews should, on the descriptive level, inform consumer concerns about matters

such as the availability of previews and copying policies. Beyond these two levels, there is the general level of instructional and courseware criteria. This level assumes sophistication on the part of practitioners. The questions that address instructional and courseware criteria might include:

9. How does this program compare in learning efficiency with instructional alternatives?
10. How does this package affect attitude toward a subject?
11. Can groups of students or a whole class efficiently use this software? With what results? Under what conditions?
12. With which instructional strategies might this software package be coordinated?
13. What record keeping is supplied by the program?
14. Is there an instructional design theory for this package? If so, what are its assumptions and what does it predict as a result of using these materials?
15. What use is made of the graphic capabilities?
16. What use is made of interactive capabilities?
17. Are other instructional materials available for teacher as well as student use?

The above list suggests questions to be asked of all microware. Sources cited would indicate specifics.

A third list focuses upon criteria more appropriately applied to microcomputer-based social studies simulation/games:

18. What is the model this simulation/games teaches?
19. Which social science concepts and generalizations might be taught by using this program?
20. How many and which variables are managed in this

simulation/game?

21. How is the algorithm flowcharted?
22. How much role flexibility or adaptation is possible?
23. What kind of information processing or thinking skils are used by learners?
24. What provision is made for evaluation of the learner by the program, the learner by peers, or the learner by him or herself?
25. What kinds of group skills might be promoted by the use this package?
26. Which special criteria might be applied to a class or category of simulation/games?

This third level should supply enough analysis to satisfy most practitioners.

Developers and researchers need information from a different perspective. Researchers and developers need to find ways to answer these questions about microcomputer-based social studies simulation/games as an instructional strategy:

1. Which are most effective to teach particular objectives?
2. How can graphics theory best be applied?
3. Which interactive techniques are most useful for this strategy?
4. How many and which variables can be mananaged by which learners?
5. Is there a model for adapting board games to this strategy?
6. Is there a model for adapting person/ascendant, whole class simulation/games?

7. How effective would a branched dialogue be for debriefing?
8. Given that diskettes can be used to store student responses in an uncoded (albeit limited) and coded form and these responses could be transmitted, what might be learned from these data?
9. Since this strategy, at present, seems to lack the affective risks of people/ascendant simulation/games, what effect is there upon cognitive and affective outcomes?
10. Do current prescriptions from research about graphics need to be revised in this medium and/or strategy?
11. Current social studies texts use more than fifty per cent graphics up to age nine. What mix of graphics to text is most appropriate for different ages using this strategy?
12. Can artificial intelligence expert problem solving systems serve as models for this strategy?
13. How might videodiscs be integrated with this strategy?
14. What effects might students using personal or school micro hardware and software at home have?
15. There are several frame games now in the person/ascendant mode. These are simulation/games that can be used with a variety of concepts and topics. Can similar frame games be developed for this strategy?
16. Simulations have been played internationally but microcomputer technology now makes this option available to all. What effects might this development have?
17. What changes in school organization might this strategy and its accompanying technology cause?

As researchers, developers, and practitioners begin to address

these questions, more analytical criteria will emerge.

REFERENCES

Allen, William H. "Intellectual Abilities and Instructional Media Design." AV Communication Review. 1975, 23, 139-170.

Anderson, Ronald E. "Computer Simulation Games: Exemplars." in Horn, Robert E. and Cleaves, Anne (Eds.). The Guide to Simulation/Games for Education and Training. Fourth Edition. Beverly Hills: Sage Publications, Inc., 1980, 37-46.

Association for Educational Communication and Technology. Educational Technology: Definition and Glossary of Terms. Volume 1. Washington, D.C.: Association for Educational Communications and Technology, 1977.

Bagley, Earl G. "Simulation Game Research at the Early Elementary Level." Social Education. 1973, 38, 3, 288-290.

Bottinelli, Charles A. "Energy and Environmental Quality Games and Simulations: An Evaluation." in Horn, Robert E. and Cleaves, Ann. (Editors) The Guide to Simulations/Games for Education and Training. 4th Edition. Beverly Hills: Sage Publications, Inc., 1980, 86-97.

Bracey, Gerald W. "Computers in Education: What Research Shows." Electronic Learning. November/December, 1982, 2,3, 51-54.

Braden, Roberts A. and Sachs, Steven G. "The Most Recommended Books on Instructional Development." Educational Technology. 1983, 23, 2, 24-28.

Bredemeier, Mary and Greenblat, Cathy Stein. "The Educational Effectiveness of Simulation Games: A Synthesis of Findings." Simulation & Games 1981,12, 320-21.

Bruner, Jerome S. The Growth of Mind. Occasional Paper No. 8, The Social Studies Curriculum Program, Cambridge, Massachusetts: Educational Services Incorporated, 1966.

Bullock, Donald H. Programmed Instruction. Englewood Cliffs, New Jersey: Educational Technology Publications, 1978.

Bunderson, C. Victor and Faust, Gerald W. "Programmed and Computer-Assisted Instruction." in N. L. Gage The Psychology of Teaching Methods. (The Seventy-fifth Yearbook of the National Society for the Study of Education; Part I). Chicago: University of Chicago Press, 1976, 44-90.

Byrne, Donna M. "Computer Uses in the Social Studies." in Grady, M. Tim and Gawronski, Jane D. Computers in Curriculum and Instruction. Alexandria, Virginia: Association for Supervision and Curriculum Development, 1983, 124-126.

Chapman, Katherine and Cousins, Jack E. Simulation/Games in Social Studies: A Report. (SSEC Publication No. 164), ERIC Clearinghouse for Social Studies/ Social Science Education (ERIC/ChESS) and Social Science Education Consortium, Inc., 1974.

Cohen, Mollie L. "Educational Software: A Taste of What's Available for Social Studies." The Computing Teacher.

December, 1982, 11-15.

Cohen, Richard and Bradley, Robert H. "Teaching Superordinate Concepts with Simulation Games." The Alberta Journal of Educational Research. 1977, 23, 4, 298-304.

Cohen, Vicki L. Blum. "Evaluating Instrucitional Software for the Microcomputer." (ERIC Document ED 216 704) March, 1982.

Cohen, Vicki Blum. "Criteria for the Evaluation of Microcomputer Courseware." Educational Technology. January, 1983, 23, 1, 9-13.

Coombs, Don H. "Is There A Future For Simulation and Gaming Research?" Edcuational Communication and Technology Journal. 1978, 26, 2, 99-106.

Davis, Robert B. "The Postulation of Certain Specific, Explicit, Commonly-Shared Frames." Journal of Mathematical Behavior. 1980, 3, 167-201.

Dayton, Deane K. "Future Trends in the Production of Instructional Materials: 1981-2001." Educational Communication and Technology Journal. 1981, 29, 4, 231-249.

Denenberg, Stewart A. "A Personal Evaluation of the PLATO System." ACM Siguce Bulletin. 1978, 12, 2, 3-10.

Dennis, J. Richard. Computer Simulation and Its Instructional Uses. (The Illinois Series on Educational Application of Computers; Number 8e), Urbana, Illinois: Department of Secondary Education, University of Illinois, 1979.

Diem, Richard A. "Computers in the Social Studies Classroom." How to Do It Series 2, No. 14, Washington D. C.: National Council for the Social Studies, 1981

Duke, Richard D. Gaming: the Future's Language. New York: Halsted Press, 1974.

Dwyer,Francis M. Strategies for Improving Visual Learning. State College, Pennsylvania: Learning Services, 1978.

Eisele, James. "Computers in the Schools: Now that We Have Them...?." Educational Technology. , 1981, 21, 10 24-27.

Electronic Learning.(1982a) "My Favorite Software." 2, 2, October, 1982, 51-55.

Electronic Learning. (1982b) "How to Find Good Software." 2, 2, October, 1982, 40-43.

Electronic Learning. (1982c) "The Software Line-up: What Reviewers Look For When Evaluating Software." 2, 2, October, 1982, 45-48.

EPIE & Consumers Union. "Geography Search." EPIE & Consumers Union Micro-Courseware PRO/File & Evaluation. N.P. EPIE Institute, 1983.

Farra, Harry. "Self-Development Games and Simulations: an Evaluation." in Horn, Robert E. and Cleaves, Ann. (Editors) The Guide to Simulations/Games for Education and Training, 4th Edition. Beverly Hills: Sage Publications, Inc., 1980, 223-238.

Fisher, Glenn. "Lemonade (And Other Simulations) for Sale." Electronic Learning. 2, 5, February, 1983, 79-82.

Gagné, Robert M. "Domains of Learning." Interchange. 1972, 3, 1, 1-8.

Gagné, Robert M. and Briggs, Leslie J. Principles of Instructional Design: Second Edition. New York: Holt, Rinehart and Winston, 1979.

Gaines, W. George. "Systematic Evaluation of Social Science Classroom Simulations and Games." Audiovisual Instruction. December, 1973, 18, 10, 28-32.

Garson, James W. "Developing Interactive Graphics Courseware for Computer Literacy." ACM Sigcue Bulletin. 1982, 15, 4, 2-13.

Gibbs, G. Ian. Dictionary of Gaming, Modelling and Simulation. Beverly Hills: Sage Publications Inc., 1978.

Gillespie, Judith A. "Analyzing and Evaluating Classroom Games." Social Education. ??, 1, January, 1972, 33-42, 94.

Grayson, Lawrence P. "New Technologies in Education." Encyclopedia of Educational Research. Fifth Edition, New York: The Free Press, 1982, 1325-1336.

Greenblat, Cathy S. and Duke, Richard D. Gaming-Simulation: Rationale, Design, and Applications. New York: Halsted Press, 1975.

Greenblat, Cathy Stein and Uretsky, Myron. "Simulation in Social Science." American Behavioral Scientist. 1977, 20, 3, 411-426.

Greenblat, Cathy Stein. "Games and Simulation." Encyclopedia of Educational Research, Fifth edition, New York: The Free Press, 1982, 713-716.

Greeno, Joseph P. "A Study of Problem Solving." in Glaser, Robert (ed.), Advances in Instructional Psychology, Volume 1. Hillsdale, New Jersey: Lawrence Erlbaum Associates, Publishers, 1978, 13-75.

Hall, Keith A. "Computer-Based Education." Encyclopedia of Educational Research. Fifth Edition, New York: The Free Press, 1982, 353-367.

Henderson, Bob G. Gaines, W. George. "Assessment of Selected Simulations and Games for the Social Studies." Social Education. 1971, 35, 5, 508-513.

Hess, Robert D. and Tenazakis, Maria D. "Selected Findings From 'The Computer as a Socializing Agent: Some Socioaffective Outcomes of CAI'." AV Communication Review. 1973, 21, 3, 311-325.

Horn, Robert E. and Cleaves, Ann. (Editors) The Guide to Simulations/Games for Education and Training, 4th Edition. Beverly Hills: Sage Publications, Inc., 1980.

Howsam, Robert B., Corrigan, Dean C., Denemark, George W. and Nash, Robert J. Educating A Profession: Report of the

Bicentennial Commission on Education for the Profession of Teaching of the American Association of Colleges for Teacher Education. Washington, D. C.: American Association of Colleges for Teacher Education, 1976.

Inbar, Michael and Stoll, Clarice S. Simualtion and Gaming in Social Science. New York: The Free Press, 1972.

Jackson, M. W. "An Antipodean Evaluation of Simulation in Teaching." Simulation & Games. 1979, 10, 2, 99-138.

Jay, Timothy B. "The Cognitive Approach to Computer Courseware Design and Evaluation." Educational Technology. 1983, 23,1, 22-25.

Klassen, Dan L. and Rawitsch, Don G. "Social Studies and the Computer." ACM Topics: Computer Education for Elementary and Secondary Schools. A Joint Issue of the Education Board of ACM, SIGCSE and SIGCUE, January, 1981, 82-86.

Kulik, James A. Bangert, Robert L. and Williams, George W. "Effects of Computer-Based Teaching On Secondary School Students." Journal of Educational Psychology. 1983, 75, 1, 19-26.

Lave, Charles A. and March, James G. An Introduction to Models in the Social Sciences. New York: Harper and Row, Publishers, 1975.

MECC System Library. Elementary Volume 6. St. Paul, Minnesota: Minnesota Education Computing Consortium. 23-37.

Markle, Susan Meyer. Good Frames and Bad: A Grammar of Frame

Writing, 2nd Edition. New York: John Wiley & Sons, Inc., 1969.

Markle, Susan M. "Training Designers to Think About Thinking." Journal of Instructional Development. 1981, 4, 24-27.

Marler, Jerilyn (Ed.). "MicroSIFT News. October 1980 ((and)) October, 1981." Portland, Oregon: Northwest Regional Educational Laboratory, 1981 (ERIC Document 216 671).

Marsh. Colin J. "Simulation Games and the Social Studies." Theory Into Practice. 1981, 20, 3, 187-193.

Martorella, Peter H. "Cognition Research: Some Implications for the Design of Social Studies Instructional Materials." Theory and Research in Social Education. 1982, 10, 1-16.

McGuire, Christine H., Solomon, Lawrence M., and Bashook, Philip G. Construction and Use of Written Simulations. n. p. The Pyschological Corporation, 1976.

Mehaffy, George, Atwood, Virginia and Nelson, Murray. "Action Learning in the Social Studies." in Mehlinger, Howard D. and Davis, O. L. (Eds.) The Social Studies. (Eightieth Yearbook of the National Society for the Study of Education, Part II) Chicago: National Society for the Study of Education, 1981, 191-202.

Menges, Robert J. and Girard, Dennis L. "Development of a Research Specialty: Instructional Psychology Portrayed in The Annual Review of Psychology." Instructional Science. 1983, 12, 83-98.

Merrill, Paul F. and Bunderson, C. Victor. "Preliminary Guidelines for Employing Graphics in Instruction." Journal of Instructional Development. 1981, 4, 4, 2-9.

MicroSift. "Evaluator's Guide for Mircocomputer-Based Instructional Packages." Portland, Oregon: Northwest Regional Educational Laboratory, (ERIC Document 206 330).

National Council of Teachers of Mathematics. Guidelines for Evaluating Computerized Instructional Materials. Reston, Virginia: National Council of Teachers of Mathematics, Inc., 1981.

Nevo, David. "The Conceptualization of Educational Evaluation: An Analytical Review of the Literature." Review of Educational Research. 1983, 53, 1, 117-128.

Newell, Allen. "The Knowledge Level." Artificial Intelligence. 1982, 18, 87-127.

Okey, James R. and Majer, Kenneth. "Individual and Small-Group Learning with Computer-Assisted Instruction." AV Communication Review. 1976, 24,1, 79-86.

Orbach, Eliezer. "Some Theoretical Consideratons in the Evaluation of Instructional Simualtion Games." Simulation & Games. 8, 1977, 341-360.

Orbach, Eliezer. "Simulation Games and Motivation for Learning," Simulation & Games. 1979, 10, 3-8.

Pascale, Victor and Ehrman, Theodore. "Economics Games and Simulations: An Evaluation." in Horn, Robert E. and Cleaves, Ann. (Editors) The Guide to Simulations/Games for Education and Training, 4th Edition. Beverly Hills: Sage Publications, Inc., 1980, 69-79.

Pierfy, David A. "Comparative Simulation Game Research: Stumbling Blocks and Stepping Stones," Simulation & Games 1977, 8, 260-66.

Pierfy, David A. "Games for the Middle School Classroom: Data Sources for Discussion and Interpretation." Social Education. 1974, 38, 3, 291-94.

Plummer, Charles M. "Futures Games and Simulations: an Evaluation." in Horn, Robert E. and Cleaves, Ann. (Editors) The Guide to Simulations/Games for Education and Training, 4th Edition. Beverly Hills: Sage Publications, Inc., 1980, 108-131.

Rakow, Steven J., Glenn, Allen D., and Fifer, William E. "Acid Rain: Board Game to Computer Simulation." Simulation & Games. 1983, 14, 29-46.

Roberts, Nancy. "Simulation Gaming: A Critical Review." 1976, (ERIC Document 137 165).

Roberts, Nancy, Anderson, David F., Deal, Ralph M., Garet, Michael S. and Shafer, William A. Introduction to Computer Simulation: The System Dynamics Approach. Reading, Massachusetts:

Addison-Wesley Publishing Company, 1983.

Roblyer, M. D. "When Is It 'Good Courseware'? Standards for Microcomputer Courseware." Educational Technology. October, 1981, 21,10, 47-54.

Schaefer, Larry, Haakonsen, Harry O., and Elron, Orah. "Ecology/Land Use/Population Games and Simulations: An Evaluation." in Horn, Robert E. and Cleaves, Ann. (Editors) The Guide to Simulations/Games for Education and Training. 4th Edition. Beverly Hills: Sage Publications, Inc., 1980, 58-68.

Schwen, Thomas M. "Professional Scholarship in Educational Technology: Criteria for Judging Inquiry." AV Communication Review. 1977, 25, 5-24.

Seidner, Constance J. "Teaching with Simulations and Games." In N.L. Gage (Ed.), The Psychology of Teaching Methods. (The Seventy-fifth Yearbook of the National Society for the Study of Education; Part I). Chicago: University of Chicago Press, 1976, 217-251.

Senn, Peter R. and Stepien, William J. "Microcomputers: Is There Anything Beyond Drill and Practice?" Boston: Paper presented at the Annual Meeting of the National Council for the Social Studies, November, 1982.

Spritzer, Dean R. "Toward Response-Based Educational Technology." Educational Technology. May, 1980 20, 5, 33-35

Stadsklev, Ronald. "Games Analysis System. An Analytical Instrument to Help Evaluate Simulation Games." Concorida Teachers College, Seward, Nebraska, 1969 (ERIC Document 049 100).

Stadsklev, Ron. Handbook of Simulation Gaming in Social Education (Part 1: Textbook). The University of Alabama: Institute of Higher Education Research and Services, 1974.

Steffin, Sherwin A. "A Suggested Model for Establishing the Validity of Computer-Assisted Instructional Materials." Educational Technology. January, 1983, 23, 1, 20-22.

Stefik, Mark, Aikens, Jan, Balzer, Robert, Benoit,John, Birnbaum, Lawrence, Hayes-Roth, Frederick, and Sacerdoti, Earl. "The Organization of Expert Systems: A Tutorial." Artificial Intelligence. 1982, 18, 135-173.

Steinberg, Esther R. "Reviewing the Instructional Effectiveness of Computers." Educational Technology. January,1983, 23, 1, 17-19.

Strike, Kenneth A. and Posner, George J. "Epistemological Perspectives on Conceptions of Curriculum Organization and Learning." in Lee Shulman (ed.) Review of Educational Research, 4, 1976. A Publication of the American Educational Research Association, Itaska, Illinois: F. E. Peacock Publishers, Inc., 106-141.

Suransky, Leonard. " International Realtions Games and Simulations: An Evaluation." in Horn, Robert E. and Cleaves, Ann. (Editors) The Guide to Simulations/Games for Education and Training, 4th Edition. Beverly Hills: Sage Publications, Inc., 1980, 162-176.

Tennyson, Robert D. Interactive Effect of Cognitive Learning Theory with Computer Attributes in the Design of Computer-Assisted Instruction. Paper presented in the symposium, New Developments in Instrucional Systems Design and Computer-Based Instruction at the Annual Meeting of the American Educational Research Association, Los Angeles, April, 1981.

Twelker, Paul A. "Designing Simulation Systems." Educational Technology. 1969, 9, 10, 64-70.

Wager, Walter. "Using Gagné's Events of Instruction as a Guide for Producing Stimulus Materials." Journal of Instructinal Development. 1978, 2, 1, 6-8.

Wager, Walter. "Design Considerations for Instructional Computing Programs." Journal of Educational Technology Systems. 1982, 10, 3, 261-269.

Weil, Marsha and Joyce, Bruce. Social Models of Teaching Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1978.

Wentworth, Donald R. and Lewis, Darrell R. "A Review of Research On Instructional Games and Simulations in Social Studies

Education." Social Education. 1973, 37, 5, 433-440.

White, Mary Alice. " Synthesis of Research on Electronic Learning." Educational Leadership. May, 1983, 40, 8, 11-15.

Wildman, Terry M. and Burton, John K. "Integrating Learning Theory with Instructional Design." Journal of Instructional Design. 1981, 4, 1, 5-14.

Williams, Robert H. "Attitude Change and Simulation Games," Simulation & Games 11 (1980): 177-196.